Sawyer Passway

Distribution Exit Strategy
Final Recommendation
January 9, 2001

Introduction

This report makes a final recommendation on the distribution circuits exiting the new Sawyer Passway substation. The economic and environmental factors provided below will identify that an overhead exit solution is the most cost effective.

Evaluated Options

There were two options evaluated for this recommendation, overhead and underground. The overhead option consists of a pole line from the substation to the proposed riser poles located on Saywer Passway between the bridge and Hayden Passway. There will be six circuits on each pole using spacer cable construction. The circuits will enter manholes along Sawyer Passway. This is City owned land, so pole petitions will be required by City Council. The proposed riser pole layout can be seen on the attached drawing labeled Draft A.

The underground option is a bit more complicated. This option consists of four riser poles located outside of the substation fence. From these riser poles, conduits will be installed to a manhole on the property line between Parcels C and D. From this manhole, a duct bank will be installed to another new manhole located near the front corner of the building. This manhole will intersect the duct line that went to the #7 Turbine. From there, another new manhole will be required in front of the building in order to tie all of the circuits into the underground system. This option is detailed in the attached drawing labeled Draft B.

Environmental Considerations - Underground

GZA GeoEnvironmental, Inc. has reviewed both of the options. The underground option by far has a greater potential for more environmental impact than the overhead option. In their letter dated January 8, 2001, GZA only evaluated the environmental issues associated with the proposed distribution work on the Sawyer Passway site. Their evaluation does not include costs associated with other existing underground utilities or subsurface obstacles.

The prices included in the letter for the underground option ranging anywhere from $43,000 to $244,000. These prices include URAM Documentation, excavation oversight, excavation premium (OSHA Training), soil transport and disposal, and tar tank disposal.

This price does not include handling contaminated groundwater for the underground option. Based upon soil boring information that GZA has collected in the past, the groundwater would likely contain oil or hazardous materials at levels above the MCP reportable concentrations. Handling of the groundwater was not added into the initial project estimates. Based upon the large amount of impact, more exploratory test borings would be required to develop more suitable conclusions.

The groundwater level in the proposed area ranges from 1.5 feet to 6 feet below grade. During construction, this water would need to be tested at different intervals to determine the level of contamination. It is probable that the groundwater might contain materials that would require the ground water to be pumped into a tank and disposed of off site. The premium cost for this could be very high.

Based upon past soil testing information gathered on the site, high levels of contaminates exist towards the front corner of the old power station. The proposed trench might be located in such a way that the last 100 feet might be within this area of high contamination. It was assumed that all

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of the soil would need to be disposed of over this entire 100 feet. It is not certain at this point how deep the contaminated soil is. The proposed trench must go directly through an area where it is believed tar and ammonia tanks might be situated. The cost of removing one of these tanks would be high, but once unearthed, we could be required to remove all four of the tanks. The initial estimate only included the disposal of one tank.

Environmental Considerations - Overhead

Based upon information supplied, GZA estimated the environmental expenditures for the overhead option to be between $13,000 and $27,000. This estimate includes URAM Documentation, excavation oversight, excavation premium (OSHA Training), soil transport and disposal. The overhead option consists of 14 poles, each requiring a 4 foot diameter hole to a depth of 10 feet. In addition, GZA assumed 50 percent of the excavated material would require off-site disposal.

There has been a considerable amount of information gathered in the area of the proposed pole line. Most of the information is good, however there will be some challenges with the overhead option as well. One design consideration is to use steel poles mounted on foundations secured to the ground using helical anchors. Any pole using a foundation will require a test boring in that area. This will be required for the geo-technical information not just the environmental information.

Physical Protection

As stated, the overhead design will consist of a single pole line from the substation to Sawyer Passway between the bridge and Hayden Passway. The design will consist of six circuits on a single pole. Some concern has been raised about having the entire downtown system hanging on one pole.

Several options have been considered as to protecting the poles from vehicular accidents. The most feasible is to install steel poles on top of a concrete foundation. This foundation would be extended to a point and designed such that it could withstand an impact of a car.

Future Maintenance

Based upon information obtained in the soil samples, it is determined that the groundwater is contaminated above the MCP acceptable limits. Should the underground option be implemented, future access to a manhole might require special procedures for health and safety for handling the contaminated water that might accumulate within the manholes.

Before entering a manhole full of water, the crew would be required to pump the water into a storage container. Then the water should be tested and if it is contaminated, it would need to be disposed of off site. If the water was not contaminated, the water could be dumped back onto the site.

The odds of encountering a manhole with water on it is highly likely. The water table in the area of the manholes ranges from 1.5 feet to 6 feet below grade. This would increase the time and the costs associated with any future maintenance within the proposed manholes. None of this would be an issue with an overhead option.

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Construction on Sawyer Passway

The environmental contents of the soil located in Sawyer Passway between the bridge and Hayden Passway are uncertain at this time. Should any contaminated material be unearthed during the construction of the riser poles, the project could continue upon proper notification to the State and the landowner, which in this case is the City of Fitchburg. Only the contaminated material unearthed would be required to be disposed of off site. The disposal cost would be limited to the material unearthed for the pole and the conduits entering the manholes. In this situation, we would not inherit any liability as to the contents of the soil. This area is not considered a "Licensed Site" by the State of Massachusetts and our actions would fall within the utility abatement provisions of the MCP.

Massachusetts Future Requirements

An issue that remains unknown is the overall future of the Sawyer Passway site. This uncertainty might mean the money spent pursuing an underground option could be lost. The substation would not be at jeopardy because the material beneath the substation would not be required to be removed.

One way to potentially eliminate any future inquires by the State associated with the underground installation would be to remove all of the hazardous material underneath the duct bank and manholes. That excavation strategy might begin a process where we could be "chasing" the hazardous material to reach contamination levels below allowable MCP limits. All of that material would need to be disposed of and may result in a high cost.

Budgetary Impact

The following shows a breakdown of the savings produced by the overhead option.

Budget Number	Description	Underground Option	Overhead Option
DPB03	Sawyer Passway Duct Line Trans Manhole #1	$ 69,000	$ -
DPB04	Sawyer Passway Duct Line Trans Manhole #2	$ 67,000	$ -
DPB05	Elimination of Cir. #02H02	$ 3,457	$ 3,457
DPB06	Install of Sawyer Passway Distribution Circuit Cables	$ 220,000	$ -
DPB07	Sawyer Passway Distribution Conduit System	$ 127,000	$ -
DPB08	New Circuit 22W1	$ 567,262	$ 567,262
DPB09	13kV Tie Circuits to Sawyer Passway Substation	$ 37,740	$ 37,740
DPB10	Sawyer Passway Distr Circuit Terminations	$ 71,000	$ 71,000
DPB11	Transfer Circuit 9 & 13 to 22W1	$ 286,612	$ 286,612
DPB12	Sawyer Passway Distribution Circuit Exit Risers	$ 82,050	$ 40,800
	Subtotal Difference:	**$ 1,531,121**	**$ 1,006,871**
	Savings:		$ 524,250
NEW	Sawyer Passway Distribution Circuits		$ 261,000
	Total:		**$ 1,267,871**
	Savings:		**$ 263,250**

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From the estimates provided, the overhead option should provide an approximate savings of $293,250. One major factor associated with this cost savings is the environmental disposal costs. The original estimates included in the initial 2001 Capital budgetary items do not truly represent the probable disposal costs.

Another factor attributing to the savings on the overhead option is the labor associated with the trenching and installing the duct bank and manholes. All factors considered, the overhead option is the most economical solution.

Final Recommendation

The underground option provides a difficult obstacle to overcome. The scope of the environmental concerns has been a little more defined by this study. It is difficult to truly estimate a cost for disposal. This project could easily become a "black hole" for funding based on the uncertainty of the potential soil and groundwater contamination. From the information gathered, it is uncertain that the underground option can be completed for the proposed 2001 Capital budgeted amount.

It is recommended that the overhead option be used going forward in this project. The overhead option provides a cost effective solution for the distribution exit strategy at Sawyer Passway. The overhead option should take less time to construct, therefore the load can be placed on the new substation in a more timely manner.

Project Descriptions

DPB03 – SAWYER PASSWAY DUCT LINE TRANS MANHOLE #1 – **ELIMINATE**

DPB04 – SAWYER PASSWAY DUCT LINE TRANS MANHOLE #2 – **ELIMINATE**

DPB05 – ELIMINATION OF CIR. #02H02

> There is one existing customer remaining on circuit 02H02 emanating from Electric Station. This project is designed to remove the one customer from the circuit so it can be de-energized.

DPB06 – INSTALL OF SAWYER PASSWAY 13.8KV CIRCUIT CABLES – **ELIMINATE**

DPB07 – SAWYER PASSWAY DISTRIBUTION CONDUIT SYSTEM – **ELIMINATE**

DPB08 – NEW CIRCUIT 22W1

> This project is to install a new underground 13.8kV circuit from Sawyer Passway to the Rollstone Street switchgear. Included in this project is removing all of the radial load from network feeder 8 and serving it from 22W1. This circuit will also be used to serve the load transferred from circuits 9 and 13.

DPB09 – 13KV TIE CIRCUITS TO SAWYER PASSWAY SUBSTATION

> This project is to build the 13.8kV tie circuits (commonly known as 3A and 9) from the new substation over to the existing lines. This will serve as a backup to Sawyer Passway should the 06 Line have an outage.

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DPB10 – SAWYER PASSWAY DISTR CIRCUIT TERMINATIONS

This project consists of all of the underground terminations required to tie the new feeds to the existing underground system. This will include a considerable amount of switching to accomplish all of the terminations.

DPB11 – TRANSFER CIRCUIT 9 & 13 TO 22W1

This project is the actual circuit transfers onto circuit 22W1. This project will consist of installing stepdown transformers off of circuit 22W1 to pick up the 4kV load (circuits 9 and 13).

DPB12 – SAWYER PASSWAY DISTRIBUTION CIRCUIT EXIT RISERS

This project consists of installing 5 poles (4 riser poles) on Sawyer Passway between the bridge and Hayden Passway. The conduits from the riser poles will enter the adjacent manholes in order to complete the circuit terminations (DPB10).

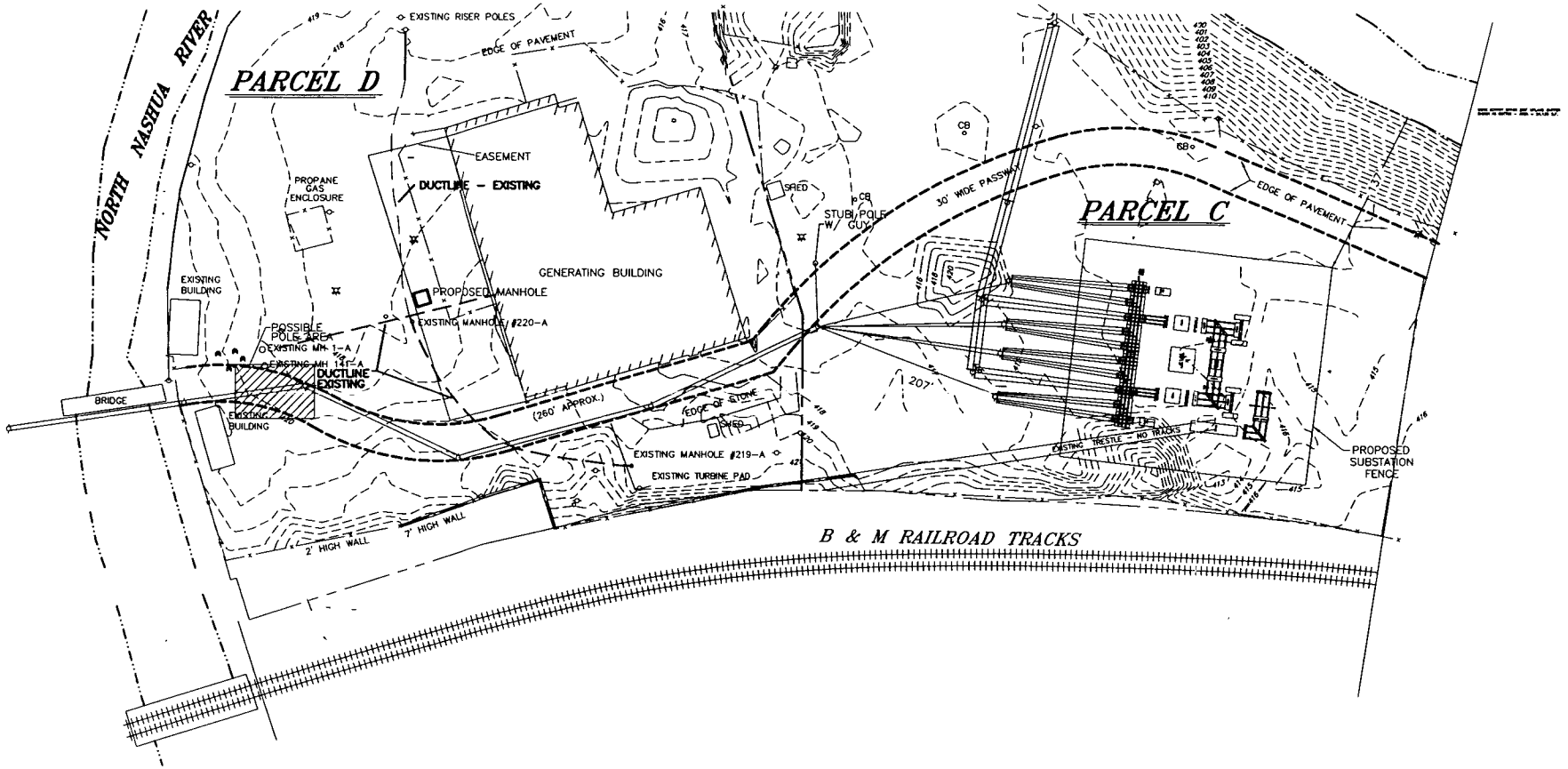
NEW – SAWYER PASSWAY DISTRIBUTION CIRCUITS

This project will consist of constructing an overhead pole line from the substation to the portion of Sawyer Passway located between the bridge and Hayden Passway. The design will consist of 6 spacer cable circuits arranged on one pole. These cables with deadend at the riser poles.

Project Schedule

Budget Number	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DPB05	Elimination of Cir. #02H02												
DPB08	New Circuit 22W1												
DPB09	13kV Tie Circuits to Sawyer Passway Substation												
DPB10	Sawyer Passway Distr Circuit Terminations												
DPB11	Transfer Circuit 9 & 13 to 22W1												
DPB12	Sawyer Passway Distribution Circuit Exit Risers												
NEW	Sawyer Passway Distribution Circuits												

Construction
Engineering



REVISIONS				
REV.	DESCRIPTION	BY	DATE	CHK. APR.

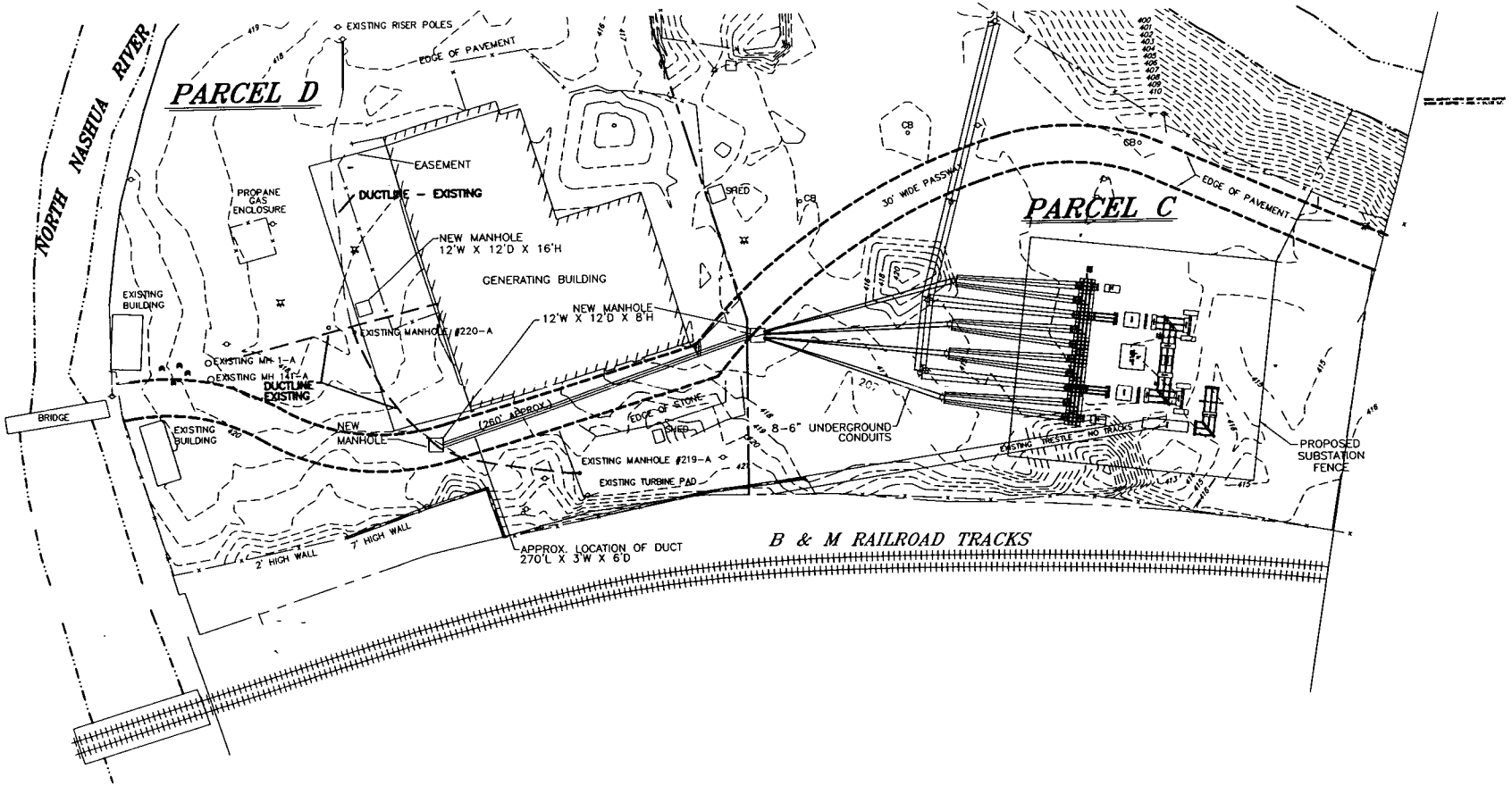
DRAWN
CHECKED
APPROVED

Unitil
Fitchburg Gas and Electric Light Company

SAWYER PASSWAY SUBSTATION #22
DISTRIBUTION CIRCUIT EXITS
OVERHEAD OPTION

SCALE	DATE	SHEET	DRAWING NO.
1" = 40'	5/25/00	1 of 1	DRAFT A

DTE 02-24/25 (Electric)
Attachment b2, AG-RR-51
Page 6 of 10



REV	DESCRIPTION	BY	DATE	CHK	APR
	REVISIONS				

DRAWN JJM
CHECKED JJK
APPROVED JJK

Unitil
Fitchburg Gas and Electric Light Company

SAWYER PASSWAY SUBSTATION #22
DISTRIBUTION CIRCUIT EXITS
UNDERGROUND OPTION

SCALE	DATE	SHEET	DRAWING NO.
1" = 40'	5/23/00	1 OF 1	DRAFT B

DTE 02-24/25 (Electric)
Attachment b2, AG-RR-51
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Sawyer Passway Distribution Exit Strategy

--Comparison of Options

Budget Number	Description	Underground Option	Overhead Option	
DPB03	Sawyer Passway Duct Line Trans Manhole #1	$ 69,000	$ -	Updated
DPB04	Sawyer Passway Duct Line Trans Manhole #2	$ 67,000	$ -	Updated
DPB05	Elimination of Cir. #02H02	$ 3,457	$ 3,457	OK
DPB06	Install of Sawyer Passway Distribution Circuit Cables	$ 220,000	$ -	Updated
DPB07	Sawyer Passway Distribution Conduit System	$ 127,000	$ -	Updated
DPB08	New Circuit 22W1	$ 567,262	$ 567,262	OK
DPB09	13kV Tie Circuits to Sawyer Passway Substation	$ 37,740	$ 37,740	OK
DPB10	Sawyer Passway Distr Circuit Terminations	$ 71,000	$ 71,000	OK
DPB11	Transfer Circuit 9 & 13 to 22W1	$ 286,612	$ 286,612	OK
DPB12	Sawyer Passway Distribution Circuit Exit Risers	$ 82,050	$ 40,800	Updated
	Subtotal:	**$ 1,531,121**	**$ 1,006,871**	
	Savings:		$ 524,250	
NEW	Sawyer Passway Distribution Circuits		$ 266,520	New
	Total:		**$ 1,273,391**	
	Savings:		**$ 257,730**	

Sawyer Passway Distribution Exit Strategy

--New Budget Item Estimate

Description		Cost		W/OH
Installation of 336 Spacer Cable				
- Cost of spacer cable and materials	$	44,520	$	163,389
- Cost of installation	$	150,000	$	229,500
Environmental	$	8,000	$	12,240
Civil Engineering	$	1,000	$	1,530
Foundations				
- 4 @ $10,000 each	$	40,000	$	61,200
Poles				
- 4 Steel @ $5,000 each	$	20,000	$	30,600
- 6 Wood @ $500 each	$	3,000	$	11,010
Total:	$	266,520	$	509,469

Sawyer Passway Distribution Exit Strategy

--New Estimate for DPB12

Description	Underground Cost	Overhead Cost
Installation of 4 poles w/ 2 risers each	$ 4,000	$ 4,000
Install conduit		
- 8 conduits @ 100' each	$ -	$ 20,000
- 8 conduits @ 400' each	$ 40,000	$ -
Install 450' of overhead conductor from S/S to poles	$ 2,250	$ -
Install Arresters	$ 1,800	$ 1,800
Excavation and inst. of manhole	$ 3,000.00	$ -
Materials as required	$ 35,000.00	$ 15,000.00
Total:	$ 86,050.00	$ 40,800.00
Savings:		$ 45,250.00

Sawyer Passway Distribution Study

Capital Budget Project Summary

8/19/99

Circuit 1 Transfer

PROJECT SUMMARY:

- This project will consist of transferring a portion of Circuit 1 out of Electric Station to Circuit 10 out of Canton Street Substation and the remainder to the 3-4 Feeder out of Beech Street Substation. With the proposed load split, most of the PILC cable can be eliminated from normal operation.
- The 3-4 feeder out of Beech Street substation is a 13.8kV feeder, therefore a bank of 7.97-2.4kV stepdown transformers would be required.
- Circuit 10 is a 4kV circuit out of Canton Street substation, therefore this would be a direct circuit transfer.

Circuit 1 Transfer

PROJECT STEPS:

- Circuit 1 - Replace 200' of 250MCM cable with overhead construction
- Circuit 1 - Extend three phase down Nashua Street with 336.4 AA
- 3-4 Feeder - Reconductor 1,000 circuit feet to 336.4 AA
- 3-4 Feeder - Extend the 3-4 feeder 800 circuit feet with 336.4 AA
- 3-4 Feeder - Install 3-7.97-2.4kV 333kVA stepdown transformers
- Circuit 1 - Close new disconnects on Water Street (Tie to Ckt. 10)
- Circuit 1 - Open the 638J disconnects
- Circuit 1 - Open 6722 (source side) disconnects

Circuit 1 Transfer

PROJECT JUSTIFICATION:

- Eliminates a 4kV circuit from Sawyer Passway substation.
- Eliminates the old PILC cable on circuit 1 from normal operation.
- Utilizes nearby 13.8kV and extends it through the system.
- Offloads the new substation, which in turn reduces the backup requirements of Summer Street substation.
- Transfers load to lightly loaded Beech Street transformer.
- Future capacity at Beech Street and Canton Street available.

Circuit 1 Transfer

PROJECT COST (No Overheads Applied):

$58,235

Circuit 4 Transfer

PROJECT SUMMARY:

- This project will consist of transferring the existing load on circuit 4 out of Electric Station to circuit 34 out of Pleasant Street Substation. Circuit 4 has an existing tie with circuit 34 at pole 1991. Transferring all of the circuit 4 load to circuit 34 will eliminate the need for the old PILC cable.

- Before the load can be transferred, the main-line of circuit 34 should be reconductored. This will consist of reconductoring approximately 5000 circuit feet to 336.4 AA conductor.

Circuit 4 Transfer

PROJECT STEPS:

- Reconductor 5,000 circuit feet of circuit 34 (Pleasant St. to Boutelle St.)
- Install 300kVAR capacitor bank on corner of Summer and 5th St. (voltage support)
- Close the 1991J disconnects
- Open the 286J disconnects

PROJECT JUSTIFICATION:

- Straight forward cost effective project.
- Eliminates a 4kV circuit from Sawyer Passway substation.
- Eliminates the old PILC cable on circuit 4 from normal operation.

Circuit 4 Transfer

PROJECT JUSTIFICATION (cont.):

- Follows future plan for circuit 34, (convert to 13.8kV). This would eliminate 4kV from Pleasant Street Substation.
- Leaves future capacity at Pleasant Street Substation.

PROJECT COST (No Overheads Applied):

$63,034

New Circuit 8A

PROJECT SUMMARY:

- This project will consist of installing EPR cable to create a new circuit (8A) from Sawyer Passway to the Rollstone Street switchgear. At this point, it will tap into the alternate feed for the #8 feeder from Wallace Road. Circuit 8A is in addition to all of the network feeders. This project will include removing all of the radial load off the #8 feeder and relocating it to the new circuit #8A.

- There is one network transformer located beyond this point (8N13). A section of EPR cable should be run to this transformer such that this network transformer is fed out of Sawyer Passway. This piece of cable is in addition to the #8 feeder.

New Circuit 8A

PROJECT STEPS:

- Install 6,350 circuit feet of EPR cable from Sawyer Passway to the Rollstone Street switchgear on Main Street
- Install 850 circuit feet of EPR cable from Rollstone Street switchgear to vault 190-V on Main Street. This is to pick up network transformer 8N13 on the #8 network feeder.

PROJECT JUSTIFICATION:

- Enables almost all radial load to be removed from the #8 network feeder (GE building remaining on #17 feeder).
- Difficult to use alternate feed from Wallace Road in the current configuration.

New Circuit 8A

PROJECT JUSTIFICATION (cont.):

- Reduces outage durations.
- Radial customers will be placed on newer, more reliable EPR cable.
- Increased reliability of the network system - network customers will not be affected by faults to the radial customers.
- Least cost alternative to removing radial load from the network system.
- Spare ducts available the entire length.
- Existing switches can be reused in this project.

PROJECT COST (No Overheads Applied):

$252,153

Circuit 9 & 13 Transfer

PROJECT SUMMARY:

- This project is designed to use the new circuit 8A out of Sawyer Passway to serve the load on circuits 9 and 13. This new underground circuit will be located nearby on Main Street. Since the side streets up to circuits 9 and 13 have spare ducts available, this turns into a very economical solution to serving circuits 9 and 13.

PROJECT STEPS:

Circuit 13

- Install 500' of EPR cable from MH 9-A (Main St.) to MH 71-A (Willow St.)
- Install riser pole and 3-333kVA stepdown transformers on the corner of Willow Street and Morris Street

Circuit 9 & 13 Transfer

PROJECT STEPS (cont.):

- Install 400' of EPR cable from MH 21-A (Main St.) to MH 132-A (Pleasant St.)
- Extend three phase (1500') overhead on Mt. Vernon Street, down Weymouth Street, Goodwin Street, to Pleasant Street
- Install riser pole and 3-167kVA stepdown transformers on the corner of Goodwin Street and Pleasant Street
- Open 797 disconnects to split up circuit

Circuit 9

- Install 600' of EPR cable from MH 34-A (Main St.) to MH 126-A (Academy St.)
- Install a riser on Academy Street
- Install 3-250kVA stepdown transformers on Academy Street
- Install 3-250kVA stepdown transformers on Elm Street

Circuit 9 & 13 Transfer

PROJECT JUSTIFICATION:

- Circuit 8A is already required to remove radial load from network system.
- Eliminates the old PILC cable from normal operation on both circuits.
- Eliminates a 4kV circuit from Sawyer Passway substation.
- Spare ducts on side streets allow for cable installation.
- Multiple stepdown banks increase reliability of the circuits.
- Expands 13.8kV further north through the system.
- Creates backup feed from Nockege Substation.
- Transfers load to lightly loaded circuit.
- Other options much more costly.

Circuit 9 & 13 Transfer

PROJECT COST (No Overheads Applied):

$148,571

Budget Project Summary

(No Overheads Applied)

Project	***Cost***
Circuit 1 Transfer	$ 58,235
Circuit 4 Transfer	$ 63,034
New Circuit 8A	$ 252,153
Circuit 9 & 13 Transfer	$ 148,571
Total	**$ 521,993**